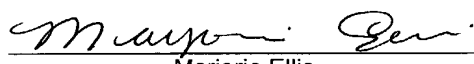
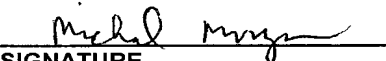


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JG05 Rec'd PCT 28 MAR 2002

FORM PTO-1390 U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		
ATTORNEY DOCKET NUMBER IN-5571	U.S. APPLICATION NO. (IF KNOWN SEE 37 RR 15) 10/089482	
INTERNATIONAL APPLICATION NO. PCT/EP00/09754	INTERNATIONAL FILING DATE 05.10.2000 (05.10.2000)	PRIORITY DATE CLAIMED 09. October 1999 (09.10.1999)
TITLE OF INVENTION: ELECTRICALLY CONDUCTING HYDROPRIMER FOR PLASTICS		
APPLICATION(S) FOR DO/EO/US: Guido WILKE		
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:		
<p>1. <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.</p> <p>2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.</p> <p>3. <input type="checkbox"/> This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371 (b) and PCT Articles 22 and 39(1).</p> <p>4. <input type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date</p> <p>5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2))</p> <p> a. <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau).</p> <p> b. <input checked="" type="checkbox"/> have been transmitted by the International Bureau.</p> <p> c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US)</p> <p>6. <input checked="" type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(C)(2)).</p> <p>7. <input checked="" type="checkbox"/> Amendment to the claims of the International Application under PCT Article 19 (35 U.S.C.371(c)(3))</p> <p> a. <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau).</p> <p> b. <input type="checkbox"/> have been transmitted by the International Bureau.</p> <p> c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired.</p> <p> d. <input checked="" type="checkbox"/> have not been made and will not be made</p> <p>8. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).</p> <p>9. <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).</p> <p>10. <input type="checkbox"/> A translation of the annex to the International Preliminary Examination Report under PCT Article 36</p>		
Items 11. to 16. below concern other document(s) or information included:		
<p>11. <input checked="" type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98.</p> <p>12. <input checked="" type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included</p> <p>13. <input checked="" type="checkbox"/> A FIRST preliminary amendment. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment.</p> <p>14. <input type="checkbox"/> A substitute specification.</p> <p>15. <input type="checkbox"/> A Change of power of attorney and/or address letter.</p> <p>16. <input checked="" type="checkbox"/> Other items or information:</p>		
<p>A copy of the cover sheet from the PCT Published Application A copy of the cover sheet from the Priority Document</p>		
<p>I hereby certify that the attached correspondence is being deposited with the United States Postal Service in an envelope as "Express Mail Post Office to Addressee" Mailing Label No. EU171212575US addressed to the Commissioner for Patents, Washington, DC 20231 on March 28, 2002</p>		
<p> Marjorie Ellis</p>		

U.S. APPLICATION NO. 10/089482 (If known see 37 CFR 1.50)		INTERNATIONAL APPLICATION NO. PCT/EP00/09754		ATTORNEY'S DOCKET NUMBER IN-5571	
17. <input checked="" type="checkbox"/> The following fees are submitted				CALCULATIONS PTO USE ONLY	
Basic National Fee (37 CFR 1.492(a)(1)-(5)): Neither international preliminary examination fee (37 CFR 1.482) Nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO.....				\$970.00	
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO.....				\$890.00	
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.44(a)(2)) paid to USPTO.....				\$690.00	
International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4).....				\$670.00	
International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4)				\$ 96.00	
ENTER APPROPRIATE BASIC FEE AMOUNT =				\$890.00	
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				\$	
Claims	Number Filed	Number Extra	Rate		
Total Claims	23 - 20 =	0 3	X \$ 18.00	\$ 54.00	
Independent claims	01 - 03 =	0	X \$ 84.00	\$	
Multiple dependent claims(s) (if applicable)			+ \$280.00	\$	
TOTAL OF ABOVE CALCULATION =				\$944.00	
Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28).				\$	
SUBTOTAL =				\$944.00	
Processing fee of \$130.00 for furnishing the English translation later the <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				\$	
TOTAL NATIONAL FEE =				\$944.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property				\$ 40.00	
TOTAL FEES ENCLOSED =				\$984.00	
				Amount to be: refunded	\$
				Charged	\$984.00
a. <input type="checkbox"/> A check in the amount of \$_____ to cover the above fees is enclosed.					
b. <input checked="" type="checkbox"/> Please charge my Deposit Account No. <u>23-3425</u> in the amount of <u>\$984.00</u> to cover the above fees A triplicate copy of this sheet is enclosed.					
c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>23-3425</u> . A triplicate copy of this sheet is enclosed.					
NOTE: Where an appropriate time limit under 37 CFR 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.					
SEND ALL CORRESPONDENCE TO: BASF CORPORATION Patent Department 26701 Telegraph Road Southfield, Michigan 48034-2442 (248) 948-2355 Customer No. 26922			 SIGNATURE Michael F. Morgan Name 42,906 REGISTRATION NUMBER		

PATENT
(Practitioner's Docket No. IN-5571)

#4/a

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Guido WILKE

Serial No.: This application is a National
Phase of Patent Application PCT/EP00/09754
filed 05 October 2000.

Filed: March 26, 2002

For: ELECTRICALLY CONDUCTING
HYDROPRIMER FOR PLASTICS

Group Art Unit: Not Assigned

Examiner: Not Assigned

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Label No. **EU171212575US** addressed to the Commissioner
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Marjorie Ellis

PRELIMINARY AMENDMENT UNDER 37 CFR § 1.115

o

Commissioner for Patents

Washington, D.C. 20231

Dear Sir:

This preliminary amendment is submitted with the application for entry into the U.S.
National Phase under Chapter II. This application is based on PCT/EP00/09754 filed on 05
October 2000.

In connection with the filing of this National Phase application, please make the
following preliminary amendments.

IN THE SPECIFICATION

After the title, please insert --This application is a National Phase Application of
Patent Application **PCT/EP00/09754** filed on 05 October 2000.--

IN THE CLAIMS:

Please cancel claims 1-19.

[illegible]

Respectfully Submitted,

Date: March 28, 2002
BASF Corporation
26701 Telegraph Road
Southfield, Michigan 48034-2442
(248)-948-2355
Customer No. 26922

Electrically conductive hydroprimer for plastics

The present invention relates to a novel electrically
conductive hydroprimer (water based primer) for
5 plastics. The present invention further relates to a
novel process for painting plastics.

In industry nowadays the use is on the increase of
plastic based moldings which are used together with
10 metal parts and which require a paint finish. This is
true particularly of automotive parts, which are
increasingly being manufactured from plastics parts,
such as, for example bumper fascias, spoilers, sills,
wheel arch linings and side trims or protection strips.

15

In order to improve the impact strength, especially the
low temperature impact strength, these plastics include
hydrophobic oligomeric rubbers, which are fundamentally
incompatible with aqueous paints. These rubbers
20 contribute to the formation of a hydrophobic boundary
layer between hydroprimer and plastics part and hence
to the delamination of the multicoat paint system.

This problem can be countered by using organic solvent
25 based primers which bring about a certain partial
dissolution or partial swelling of the plastics surface
and hence better anchoring of the primer coat. However,
the high solvent content may lead to damage to the

- 2 -

plastics part as a result, for example, of microcracks. Moreover, in production, application, and curing, considerable quantities of solvents are released, which is no longer acceptable on environmental grounds.

5

It would be possible to prevent the delamination of hydroprimer coatings by baking the hydroprimer film at temperatures $>100^{\circ}\text{C}$. This cannot be done, however, because of the absence of dimensional stability in the majority of plastics at these temperatures. Delamination of the hydroprimer coating can also be suppressed by flaming the surface of the plastics parts. This pretreatment, however, represents an additional step in the process and hence an additional cost factor and an additional source of error.

15

It is an object of the present invention to find a novel hydroprimer plastics parts which no longer has the disadvantages of the prior art but instead makes it possible to produce hydroprimer coatings for multicoat paint systems which adhere firmly, without delamination, even to unflamed plastics surfaces, and do so after thermal cure at temperatures $<100^{\circ}\text{C}$ and which permit or assist the subsequent electrostatic spray application of solid color topcoat materials, basecoat materials and/or clearcoat materials. Moreover, as part of a multicoat color and/or effect paint system, the primer coatings ought to have excellent intercoat adhesion.

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- 3 -

Accordingly, the novel hydroprimer for plastics has been found which comprises

I) at least one component comprising

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A) at least one aqueous polyurethane dispersion

B) at least one electrically conductive pigment;
and

10

II) at least one component comprising at least one polyisocyanate,

at least one of the components I and II comprising at
15 least one aromatic solvent (D).

Below, the novel electrically conductive hydroprimer for plastics is referred to as "hydroprimer of the invention".

20

Also found has been the novel process for producing multicoat color and/or effect paint systems on plastics parts by

25 1a) applying the hydroprimer of the invention and heat curing the resultant hydroprimer film to give the electrically conductive hydroprimer coating; or alternatively

- 4 -

- 1b) applying the hydroprimer of the invention, drying the resultant electrically conductive hydroprimer film, applying a light-colored hydroprimer film, and jointly heat curing the resultant electrically conductive hydroprimer film and the light-colored hydroprimer film, to give the electrically conductive hydroprimer coat and the light-colored hydroprimer coat; and
- 2a) applying a solid-color topcoat material and heat curing the resultant solid-color topcoat film to give a solid-color topcoat; or alternatively
- 2b) applying an aqueous basecoat material and partially drying the resultant aqueous basecoat film, and
- 3) applying a clearcoat material and subjecting the resultant clearcoat film and the aqueous basecoat film to a joint heat cure or a heat cure and a cure with actinic light, to give the basecoat and the clearcoat.

Below, the novel process for producing multicoat color and/or effect paint systems on plastics parts is referred to for the sake of brevity as "process of the invention".

- 6 -

Further subject matter of the invention will emerge from the description which follows.

In the light of the prior art it was surprising and unforeseeable for the skilled worker that the object of the present invention can be achieved specifically by adding comparatively small amounts of an aromatic solvent to the hydroprimer of the invention. In particular it was surprising that this measure solved the problems of adhesion not only between the plastics parts and the hydroprimer coating but also between the hydroprimer coating and the other coatings present thereon, especially the light-colored hydroprimer coating, the solid-color topcoat or the basecoat/clearcoat, and did so when a curing temperature $\leq 100^{\circ}\text{C}$ was employed. In this context it proves to be a further surprising advantage of the hydroprimer of the invention that it does not cause any damage to the plastics parts as a result, for example, of microcracking and of the emission of organic compounds during handling and curing of the hydroprimer of the invention is not significantly increased as compared with conventional hydroprimers.

The hydroprimer of the invention is a two-component or multicomponent system, in particular a two-component system.

In the context of the present invention, this means a

- 7 -

coating material in which in particular the binder, especially the aqueous binder dispersion, and the crosslinking agent are present separately from one another in at least two components which are not
5 combined until shortly before application. This form is chosen when binder, especially the aqueous binder dispersion, and crosslinking agent react with one another even at temperatures $\leq 100^{\circ}\text{C}$, in particular at room temperature. Coating materials of this kind are
10 employed in particular for coating heat sensitive substrates such as plastics parts.

The hydroprimer of the invention accordingly comprises at least one, especially one, component I and also at
15 least one, especially one, component II, or consists of these components.

Component I includes as an essential constituent at least one, especially one polyurethane dispersion (A).

20

Suitable polyurethane dispersions (A) are customary and known and are available commercially. As is known, they comprise at least one water-soluble or -dispersible polyurethane (A), which comprises, in particular,
25 polyester-polyurethanes (A).

Suitable polyester-polyurethanes (A) normally contain (potentially) cationic functional groups (a11) or (potentially) anionic functional groups (a12). Instead

of these functional groups or in addition to them they may contain nonionic functional groups (a13) based on polyalkylene ethers.

- 5 Examples of suitable functional groups (a11) for inventive use which can be converted into cations by neutralizing agents and/or quaternizing agents are primary, secondary or tertiary amino groups, secondary sulfide groups or tertiary phosphine groups, especially
10 tertiary amino groups or secondary sulfide groups.

- Examples of suitable cationic groups (a11) for inventive use are primary, secondary, tertiary or quaternary ammonium groups, tertiary sulfonium groups
15 or quaternary phosphonium groups, preferably quaternary ammonium groups or tertiary sulfonium groups, but especially quaternary ammonium groups.

- Examples of suitable functional groups (a12) for
20 inventive use which can be converted into anions by neutralizing agents are carboxylic acid, sulfonic acid or phosphonic acid groups, especially carboxylic acid groups.

- 25 Examples of anionic groups (a12) for inventive use are carboxylate, sulfonate or phosphonate groups, especially carboxylate groups.

Groups (a11) or (a12) should be selected in such a way

- 9 -

that no disruptive reactions, in particular no unwanted complexation and/or salt formation and/or crosslinking reaction, occur with the other constituents of component I or other constituents of the hydroprimer of the invention. The skilled worker is therefore able to make the selection in a simple manner on the basis of his or her art knowledge.

Examples of suitable neutralizing agents for functional groups (a11) which can be transformed into cations include inorganic and organic acids such as sulfuric acid, hydrochloric acid, phosphoric acid, formic acid, acetic acid, lactic acid, dimethylolpropionic acid or citric acid, especially formic acid, acetic acid or lactic acid.

Examples of suitable neutralizing agents for functional groups (a12) which can be transformed into anions include ammonia, ammonium salts, such as ammonium carbonate or ammonium hydrogen carbonate, for example, and also amines, such as trimethylamine, triethylamine, tributylamine, dimethylaniline, diethylaniline, triphenylamine, dimethylethanolamine, diethylethanolamine, methyldiethanolamine, triethanolamine, and the like.

25

In general the amount of neutralizing agent is chosen so that from 1 to 100 equivalents, preferably from 50 to 90 equivalents, of the functional groups (a11) or (a12) of the polyester-polyurethane (A) are

- 10 -

neutralized.

The polyester-polyurethanes (A) are obtained by reacting

5

- polyesterpolyols and
- compounds which introduce the stabilizing (potentially) ionic groups (a11) or (a12) and/or
- 10 the nonionic functional groups (a13), and if desired

- polyamines and

- 15 - amino alcohols

with polyisocyanates.

The polyesterpolyols are obtainable by reacting

20

- unsulfonated or sulfonated saturated and/or unsaturated polycarboxylic acids or their esterifiable derivatives, together if desired with monocarboxylic acids, and

25

- saturated and/or unsaturated polyols, together if desired with monoals.

Examples of suitable polycarboxylic acids are aromatic,

aliphatic, and cycloaliphatic polycarboxylic acids. It is preferred to use aromatic and/or aliphatic, especially aromatic, polycarboxylic acids.

- 5 Examples of suitable aromatic polycarboxylic acids are phthalic acid, isophthalic acid, terephthalic acid, phthalic, isophthalic or terephthalic monosulfonate, or halophthalic acids, such as tetrachlorophthalic or tetrabromophthalic acid, of which isophthalic acid is
10 advantageous and is therefore used with preference.

- Examples of suitable acyclic aliphatic or unsaturated polycarboxylic acids are oxalic acid, malonic acid, succinic acid, glutaric acid, adipic acid, pimelic
15 acid, suberic acid, azelaic acid, sebacic acid, undecanedicarboxylic acid, dodecanedicarboxylic acid or dimer fatty acids or maleic acid, fumaric acid or itaconic acid, of which adipic acid, glutaric acid, azelaic acid, sebacic acid, dimer fatty acids, and
20 maleic acid are advantageous and are therefore used with preference.

- Examples of suitable cycloaliphatic and cyclic unsaturated polycarboxylic acids are 1,2-cyclobutane-
25 dicarboxylic acid, 1,3-cyclobutanedicarboxylic acid, 1,2-cyclopentanedicarboxylic acid, 1,3-cyclopentanedicarboxylic acid, hexahydrophthalic acid, 1,3-cyclohexanedicarboxylic acid, 1,4-cyclohexanedicarboxylic acid, 4-methylhexahydrophthalic acid, tricyclodecane-

- 12 -

dicarboxylic acid, tetrahydrophthalic acid or 4-methyltetrahydrophthalic acid. These dicarboxylic acids can be used both in their cis form and in their trans form, and also as a mixture of both forms.

5

Also suitable are the esterifiable derivatives of the abovementioned polycarboxylic acids, such as, for example, their monoesters or polyesters with aliphatic alcohols having from 1 to 4 carbon atoms or polyols
10 having from 1 to 4 carbon atoms. It is also possible, furthermore, to use the anhydrides of the abovementioned polycarboxylic acids, where they exist.

If desired it is possible together with the
15 polycarboxylic acids to use monocarboxylic acids as well, such as benzoic acid, tert-butylbenzoic acid, lauric acid, isononanoic acid, fatty acids of naturally occurring oils, acrylic acid, methacrylic acid, ethacrylic acid or crotonic acid, for example. A
20 preferred monocarboxylic acid used is isononanoic acid.

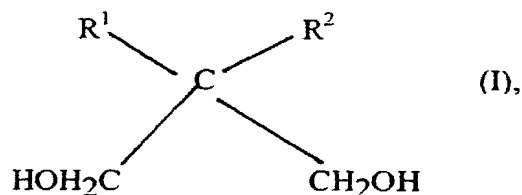
Examples of suitable polyols are diols and triols, especially diols. Normally triols are used alongside the diols in minor amounts in order to introduce
25 branching into the polyesterpolyols.

Suitable diols are ethylene glycol, 1,2- or 1,3-propanediol, 1,2-, 1,3- or 1,4-butanediol, 1,2-, 1,3-, 1,4- or 1,5-pentanediol, 1,2-, 1,3-, 1,4-, 1,5- or

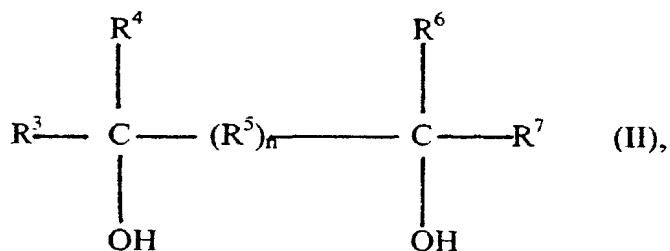
- 13 -

1,6-hexanediol, neopentyl hydroxypivalate, neopentyl glycol, diethylene glycol, 1,2-, 1,3- or 1,4-cyclohexanediol, 1,2-, 1,3- or 1,4-cyclohexanedimethanol, trimethylpentanediol, ethylbutylpropanediol, or the
 5 positionally isomeric diethyloctanediols. These diols may also be used per se for preparing the polyurethanes (A) for inventive use.

Further examples of suitable diols are diols of the
 10 formula I or II:



in which R^1 and R^2 each represent an identical or
 15 different radical and stand for an alkyl radical having from 1 to 18 carbon atoms, an aryl radical or a cycloaliphatic radical, with the proviso that R^1 and/or R^2 must not be methyl;



20

in which R^3 , R^4 , R^6 , and R^7 each represent

identical or different radicals and stand for an alkyl radical having from 1 to 6 carbon atoms, a cycloalkyl radical or an aryl radical and R^5 represents an alkyl radical having from 1 to 6 carbon atoms, an aryl radical or an unsaturated alkyl radical having from 1 to 6 carbon atoms, and n is either 0 or 1.

Suitable diols I of the general formula I include all propanediols of the formula in which either R^1 or R^2 or R^1 and R^2 is not equal to methyl, such as, for example, 2-butyl-2-ethylpropane-1,3-diol, 2-butyl-2-methylpropane-1,3-diol, 2-phenyl-2-methylpropane-1,3-diol, 2-propyl-2-ethylpropane-1,3-diol, 2-di-tert-butylpropane-1,3-diol, 2-butyl-2-propylpropane-1,3-diol, 1-dihydroxymethylbicyclo[2.2.1]heptane, 2,2-diethylpropane-1,3-diol, 2,2-dipropylpropane-1,3-diol or 2-cyclohexyl-2-methylpropane-1,3-diol, and others.

As diols II of the general formula II it is possible, for example, to use 2,5-dimethylhexane-2,5-diol, 2,5-diethylhexane-2,5-diol, 2-ethyl-5-methylhexane-2,5-diol, 2,4-dimethylpentane-2,4-diol, 2,3-dimethylbutane-2,3-diol, 1,4-(2'-hydroxypropyl)benzene and 1,3-(2'-hydroxypropyl)benzene.

Of these diols, hexanediol and neopentyl glycol are particularly advantageous and are therefore used with

particular preference.

The aforementioned diols may also be used per se for preparing the polyester-polyurethanes.

5

Examples of suitable triols are trimethylolethane, trimethylolpropane or glycerol, especially trimethylolpropane.

10 The aforementioned triols may also be used per se for preparing the polyester-polyurethanes (cf. patent EP-A-0 339 433).

If desired, minor amounts of monoools may be used as well. Examples of suitable monoools are alcohols or phenols such as ethanol, propanol, n-butanol, sec-butanol, tert-butanol, amyl alcohols, hexanols, fatty alcohols, allyl alcohol or phenol.

20 The polyesterpolyols may be prepared in the presence of small amounts of a suitable solvent as azeotrope former. Examples of azeotrope formers used include aromatic hydrocarbons, such as in particular xylene and (cyclo)aliphatic hydrocarbons, e.g., cyclohexane or
25 methylcyclohexane.

Further examples of suitable polyols are polyesterdiols obtained by reacting a lactone with a diol. They are notable for the presence of terminal hydroxyl groups

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- 17 -

hydrogen or a lower, optionally substituted, alkyl radical, the index o = 2 to 6, preferably 3 to 4, and the index p = 2 to 100, preferably 5 to 50. Especially suitable examples include linear or branched
 5 polyetherdiols such as poly(oxyethylene) glycols, poly(oxypropylene) glycols, and poly(oxybutylene) glycols.

The polyetherdiols should on the one hand not introduce excessive amounts of the ether groups, since otherwise
 10 the polyurethanes formed start to swell in water. On the other hand, they can be used in amounts which ensure the nonionic stabilization of the polyurethanes. In that case they serve as in-chain functional nonionic groups (a13).

15 (Potentially) cationic functional groups (a11) are introduced via the incorporation of compounds which contain in the molecule at least one, in particular two, groups which are reactive toward isocyanate
 20 groups, and at least one group which is capable of forming cations; the amount to be used can be calculated from the target amine number.

Suitable groups which are reactive toward isocyanate
 25 groups are, in particular, hydroxyl groups and also primary and/or secondary amino groups, of which the hydroxyl groups are used with preference.

Examples of suitable compounds of this kind are 2,2-

- 18 -

dimethylolethyl- or -propylamine, which have been blocked with a ketone, the resulting ketoxime group being hydrolyzed again before the cationic group (b11) is formed, or N,N-dimethyl-, N,N-diethyl- or N-methyl-
 5 N-ethyl-2,2-dimethylolethyl- or -propylamine.

(Potentially) anionic groups (a12) are introduced into the polyurethane molecules by the incorporation of compounds which contain in the molecule at least one
 10 group which is reactive toward isocyanate groups and one group which is capable of forming anions; the amount to be used can be calculated from the target acid number.

15 Examples of suitable compounds of this kind are those which contain in the molecule two groups which are reactive toward isocyanate groups. Suitable groups which are reactive toward isocyanate groups are, in particular, hydroxyl groups, and also primary and/or
 20 secondary amino groups. Accordingly it is possible, for example, to use alkanolic acids having two substituents on the α -carbon atom. The substituent may be a hydroxyl group, an alkyl group or, preferably, an alkylol group. These alkanolic acids have at least one, generally from
 25 1 to 3, carboxyl groups in the molecule. They have from 2 to about 25, preferably from 3 to 10, carbon atoms. Examples of suitable alkanolic acids are dihydroxypropionic acid, dihydroxysuccinic acid, and dihydroxybenzoic acid. One particularly preferred group

- 19 -

of alkanolic acids are the α,α -dimethylolalkanoic acids of the general formula $R^{10}-C(CH_2OH)_2COOH$, in which R^{10} stands for a hydrogen atom or an alkyl group having up to about 20 carbon atoms. Examples of especially
 5 suitable alkanolic acids are 2,2-dimethylolacetic acid, 2,2-dimethylolpropionic acid, 2,2-dimethylolbutyric acid, and 2,2-dimethylolpentanoic acid. The preferred dihydroxyalkanoic acid is 2,2-dimethylolpropionic acid. Examples of compounds containing amino groups are α,δ -
 10 diaminovaleric acid, 3,4-diaminobenzoic acid, 2,4-diaminotoluenesulfonic acid, and 2,4-diaminodiphenyl ether sulfonic acid.

Nonionic stabilizing poly(oxyalkylene) groups (a13) may
 15 be introduced as lateral or terminal groups into the polyurethane molecules. For this purpose it is possible, for example, to use alkoxy poly(oxyalkylene) alcohols with the general formula $R^{11}O-(-CH_2-CH^{12}-O-)_rH$ in which R^{11} stands for an alkyl radical having from 1
 20 to 6 carbon atoms, R^{12} for a hydrogen atom or an alkyl radical having from 1 to 6 carbon atoms, and the index r for a number between 20 and 75. (cf. patents EP-A-0 354 261 or EP-A-0 424 705).

25 Suitable polyisocyanates include in principle all of the customary and known polyisocyanates and polyisocyanate adducts that are used in the coatings field and are aliphatic, cycloaliphatic, aliphatic-cycloaliphatic, aromatic, aliphatic-aromatic and/or

- 20 -

cycloaliphatic-aromatic, these also being referred to as paint polyisocyanates. Especially suitable polyisocyanates are diisocyanates.

- 5 Examples of suitable diisocyanates are isophorone diisocyanate (= 5-isocyanato-1-isocyanatomethyl-1,3,3-trimethylcyclohexane), 5-isocyanato-1-(2-isocyanatoethyl-1-yl)-1,3,3-trimethylcyclohexane, 5-isocyanato-1-(3-isocyanatoprop-1-yl)-1,3,3-trimethylcyclohexane,
- 10 5-isocyanato-(4-isocyanatobut-1-yl)-1,3,3-trimethylcyclohexane, 1-isocyanato-2-(3-isocyanatoprop-1-yl)-cyclohexane, 1-isocyanato-2-(3-isocyanatoethyl-1-yl)cyclohexane, 1-isocyanato-2-(4-isocyanatobut-1-yl)cyclohexane, 1,2-diisocyanatocyclobutane, 1,3-
- 15 diisocyanatocyclobutane, 1,2-diisocyanatocyclopentane, 1,3-diisocyanatocyclopentane, 1,2-diisocyanatocyclohexane, 1,3-diisocyanatocyclohexane, 1,4-diisocyanatocyclohexane, dicyclohexylmethane 2,4'-diisocyanate, dicyclohexylmethane 4,4'-diiso-
- 20 cyanate, liquid dicyclohexylmethane 4,4'-diisocyanate with a trans/trans content of up to 30% by weight, preferably 25% by weight, and in particular 20% by weight, which is obtainable by phosgenation of isomer mixtures of bis(4-aminocyclohexyl)methane or by
- 25 fractional crystallization of commercial bis(4-isocyanatocyclohexyl)methane in accordance with patents DE-A-44 14 032, GB-A-1220717, DE-A-16 18 795 or DE-A-17 93 785, trimethylene diisocyanate, tetramethylene diisocyanate, pentamethylene diisocyanate, hexamethyl-

15 Alongside the diisocyanates it is possible to use polyisocyanates of higher functionality, having a statistical average functionality of from 2.5 to 6, in particular from 2.5 to 5, in minor amounts. For the purposes of the present invention, minor amounts are
20 amounts which do not lead to gelling of the polyester-polyurethanes (A).

Examples of suitable polyisocyanates of higher functionality are polyurethane prepolymers containing isocyanate groups, which can be prepared by reacting polyols with an excess of diisocyanates and are preferably of low viscosity. It is also possible to use polyisocyanates containing isocyanurate, biuret, allophanate, iminooxadiazinedione, urethane, urea,

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carbodiimide and/or uretdione groups. Polyisocyanates containing urethane groups, for example, are obtained by reacting some of the isocyanate groups with polyols, such as trimethylolpropane and glycerol, for example.

5 It is preferred to use the diisocyanates described in detail above.

Very particular preference is given to using mixtures of polyisocyanate adducts which contain uretdione
10 and/or isocyanurate and/or allophanate groups and are based on hexamethylene diisocyanate, such as are formed by catalytic oligomerization of hexamethylene diisocyanate using appropriate catalysts.

15 Gelling may also be prevented by using chain-terminating monoisocyanates in addition. Examples of suitable monoisocyanates are hexyl isocyanate, nonyl isocyanate, lauryl isocyanate, stearyl isocyanate or phenyl isocyanate.

20

The use of polyols, polyamines, and amino alcohols leads to an increase in the molecular weight of the polyurethanes (A).

25 Suitable polyols for the chain extension are polyols having up to 36 carbon atoms per molecule such as ethylene glycol, diethylene glycol, triethylene glycol, 1,2-propanediol, 1,3-propanediol, 1,4-butanediol, 1,2-butylene glycol, 1,6-hexanediol, trimethylolpropane,

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castor oil or hydrogenated castor oil, di-trimethylolpropane ether, pentaerythritol, 1,2-cyclohexanediol, 1,4-cyclohexanedimethanol, bisphenol A, bisphenol F, neopentyl glycol, neopentyl glycol
5 hydroxypivalate, hydroxyethylated or hydroxypropylated bisphenol A, hydrogenated bisphenol A or mixtures thereof (cf. patents EP-A-0 399 433, EP-A-0 436 941, EP-A-0 517 707).

10 Examples of suitable polyamines contain at least two primary and/or secondary amino groups. Polyamines are essentially alkylene polyamines having from 1 to 40 carbon atoms, preferably from about 2 to 15 carbon atoms. They may carry substituents which have no
15 hydrogen atoms that are reactive with isocyanate groups. Examples are polyamines having a linear or branched aliphatic, cycloaliphatic or aromatic structure and containing at least two primary amino groups.

20

Diamines include hydrazine, ethylenediamine, propylenediamine, 1,4-butylenediamine, piperazine, 1,4-cyclohexyldimethylamine, 1,6-hexamethylenediamine, trimethylhexamethylenediamine, methanediamine, isophorone-
25 diamine, 4,4'-diaminodicyclohexylmethane, and amino-ethylenethanolamine. Preferred diamines are hydrazine, alkyl- or cycloalkyldiamines such as propylenediamine and 1-amino-3-aminomethyl-3,5,5-trimethylcyclohexane.

It is also possible to use polyamines containing more than two amino groups in the molecule. In these cases, however, it should be ensured - by using monoamines as well, for example - that crosslinked polyurethane
5 resins are not obtained. Polyamines of this kind which can be used are diethylenetriamine, triethylenetetramine, dipropylenediamine, and dibutylenetriamine. An example of a monoamine that may be mentioned is ethylhexylamine (cf. patent EP-A-
10 0 089 497).

Examples of suitable amino alcohols are ethanolamine, diethanolamine or triethanolamine.

15 The polyurethanes may contain terminal and/or lateral olefinic unsaturated groups. Groups of this kind can be introduced, for example, with the aid of compounds which contain at least one isocyanate-reactive group, especially hydroxyl group, and at least one vinyl
20 group. Examples of suitable compounds of this kind are trimethylolpropane monoallyl ether or trimethylolpropane mono(meth)acrylate.

The polyurethanes (A) may be grafted with ethylenically
25 unsaturated compounds. Examples of suitable polyurethanes (A) for use in accordance with the invention which are present as graft copolymers are known from patents EP-A-0 521 928, EP-A-0 522 420, EP-A-0 522 419 or EP-A-0 730 613.

The preparation of the polyurethanes (A) has no special features in terms of its method but instead takes place in accordance with the customary and known methods of polyurethane chemistry.

For preparing the hydroprimer of the invention the polyurethanes are neutralized with the neutralizing agents described above and dispersed in water to give a dispersion having a solids content of preferably from 10 to 70%, more preferably from 20 to 60%, with particular preference from 25 to 50%, and in particular from 30 to 45% by weight, based in each case on the dispersion.

The further essential constituent of component I of the hydroprimer of the invention is at least one electrically conductive pigment (B). Examples of suitable electrically conductive pigments (B) are metal pigments, conductivity blacks, doped pearlescent pigments or conductive barium sulfate. Especially suitable electrically conductive pigments are the conductivity blacks. For further details, refer to Römpp Lexikon Lacke und Druckfarben, Georg Thieme Verlag, Stuttgart, New York, 1998, "metal pigments", p. 381 and "conductive pigments", p. 354.

The amount of electrically conductive pigments (B) in the hydroprimer of the invention may vary very widely

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antimony, bismuth, iron or manganese, preferably
organic salts and complexes of bismuth and of tin,
especially bismuth lactate, ethylhexanoate or
dimethylolpropionate, dibutyltin oxide or
5 dibutyltin dilaurate;

- slip additives;

- polymerization inhibitors;

- defoamers;

- emulsifiers, especially nonionic emulsifiers such
as alkoxyated alkanols and polyols, phenols and
15 alkylphenols or anionic emulsifiers such as alkali
metal salts or ammonium salts of alkanecarboxylic
acids, alkanesulfonic acids, and sulfo acids of
alkoxyated alkanols and polyols, phenols and
alkylphenols;

- wetting agents such as siloxanes, fluorous
compounds, carboxylic monoesters, phosphates,
polyacrylic acids and their copolymers, or
polyurethanes;

- adhesion promoters;

- leveling agents;

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- film-forming auxiliaries such as cellulose derivatives;
- flame retardants;
- 5
- low molecular mass, oligomeric, and high molecular mass reactive diluents which may participate in thermal crosslinking, especially polyols such as tricyclodecanedimethanol, dendrimeric polyols, 10 hyperbranched polyesters, polyols based on metathesis oligomers or branched alkanes having more than eight carbon atoms in the molecule;
- anticrater agents;
- 15
- water-miscible organic solvents and/or
- rheology control additives, such as those from patents WO 94/22968, EP-A-0 276 501, EP-A- 20 0 249 201 or WO 97/12945; crosslinked polymeric microparticles, such as those disclosed, for example, in EP-A-0 008 127; inorganic phyllosilicates, preferably smectites, especially montmorillonites and hectorites, such as aluminum 25 magnesium silicates, sodium magnesium phyllosilicates and sodium magnesium fluorine lithium phyllosilicates of the montmorillonite type or inorganic phyllosilicates such as aluminum magnesium silicates, sodium magnesium

phyllosilicates and sodium magnesium fluorine lithium phyllosilicates of the montmorillonite type (for further details, refer to the book by Johan Bielemann "Lackadditive" [Additives for coatings], Wiley-VCH, Weinheim, New York, 1998, pages 17 to 30); silicas such as Aerosils; or synthetic polymers containing ionic and/or associative groups such as polyvinyl alcohol, poly(meth)acrylamide, poly(meth)acrylic acid, polyvinylpyrrolidone, styrene-maleic anhydride copolymers or ethylene-maleic anhydride copolymers and their derivatives or hydrophobically modified polyacrylates; or polyurethane-based associative thickeners, as described in Römpp Lexikon Lacke und Druckfarben, Georg Thieme Verlag, Stuttgart, New York, 1998, "thickeners", pages 599 to 600, and in the textbook "Lackadditive" by Johan Bieleman, Wiley-VCH, Weinheim, New York, 1998, pages 51 to 59 and 65;

Further examples of suitable coatings additives are described in the textbook "Lackadditive" by Johan Bieleman, Wiley-VCH, Weinheim, New York, 1998.

Component II of the hydroprimer of the invention comprises or consists of at least one polyisocyanate.

Examples of suitable polyisocyanates are those described above.

In the hydroprimer of the invention, the ratio of component I to component II may vary very widely. It is guided in particular by the concentration of the isocyanate-reactive groups in component I, particularly in the polyurethane (A), especially in the polyester-polyurethane (A), and/or by the target crosslinking density for the hydroprimer coating of the invention. This ratio I:II is advantageously from 100:1 to 100:20,

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group consisting of mononuclear or polynuclear aromatics or heteroaromatics which are unsubstituted or are mono-, di- or trisubstituted by alkyl, cycloalkyl, perhaloalkyl, perhalocycloalkyl alkyloxy, cycloalkoxy
5 and/or perhaloalkyloxy groups, it also being possible for said groups to be linked cyclically to the aromatic nucleus or nuclei, and also mononuclear or polynuclear aromatics or heteroaromatics which are mono-, di- or trisubstituted by nitrile and/or nitro groups and/or
10 halogen atoms.

Examples of suitable alkyl groups are methyl, ethyl, propyl, isopropyl, n-butyl, isobutyl and tert-butyl groups.

15 Examples of suitable cycloalkyl groups are cyclopentyl and cyclohexyl groups.

Examples of suitable perhaloalkyl groups are
20 trifluoromethyl, pentafluoroethyl, and nonafluorobutyl groups.

Examples of suitable alkoxy groups are methoxy, ethoxy, propyloxy, and butoxy groups.

25 Examples of suitable cycloalkoxy groups are cyclopentoxy and cyclohexoxy groups.

Examples of suitable perfluoroalkoxy groups are

trifluoromethoxy, pentafluoroethoxy, and
nonafluorobutoxy groups.

Examples of suitable cyclically linked groups are
5 propane-1,3-diyl, butane-1,4-diyl, 1-oxabutane-1,4-
diyl, 2-oxabutane-1,4-diyl, and 1,4-dioxabutane-1,4-
diyl groups.

Examples of suitable halogen atoms are fluorine,
10 chlorine or bromine.

As aromatic solvents (D) it is preferred to use
mononuclear aromatics and/or heteroaromatics. With
particular preference the aromatic nucleus comprises a
15 benzene nucleus and the heteroaromatic nucleus
comprises a thiophene, pyridine and/or triazine
nucleus. Very particular preference is given to
employing the benzene nucleus.

20 Examples of suitable aromatic solvents (D) based on the
benzene nucleus are benzene, toluene, o-, m- and/or
p-xylene, mesitylene, pseudocumene, hemellitene,
ethylbenzene, cumene, p-cymene, tert-butylbenzene,
chlorobenzene, o-, m- and/or p-dichlorobenzene,
25 fluorobenzene, o-, m- and/or p-difluorobenzene,
perfluorobenzene, nitrobenzene, benzonitrile,
methoxybenzene, ethoxybenzene or thiophene, of which
the xylenes are used with particular preference. Very
particular preference is given to using technical grade

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preferably conducted at temperatures which pose no risk of deformation of the plastics parts. Preference is given to employing temperatures $\leq 100^{\circ}\text{C}$, in particular from 80 to 95°C .

5

Alternatively, in the first step of the process the hydroprimer of the invention is applied, the resultant electrically conductive hydroprimer film is dried, a light-colored hydroprimer film is applied wet on wet,
10 and the resultant electrically conductive hydroprimer film and light-colored hydroprimer film are jointly heat cured to give the hydroprimer coating of the invention and the light-colored hydroprimer coating.

15 Examples of suitable light-colored hydroprimers for use in accordance with the invention are likewise two-component systems. Their component I comprises at least one hydroxyl-containing binder in solution or dispersion in water and at least one light-colored
20 pigment, and their component II comprises at least one polyisocyanate. Suitable hydroxyl-containing binders include polyesters, polyacrylates, polyurethanes, acrylated polyesters and/or acrylated polyurethanes, especially polyurethanes. Examples of suitable
25 polyurethanes are the above-described polyurethanes (A). Examples of suitable light-colored pigments are the above-described pigments (B) and (C) and also the pigments described below, insofar as they are light in color and opaque. Suitable components II include the

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components II described above. This variant of the process of the invention is employed when it is necessary to color match between the dark hydroprimer coating of the invention and the light-colored topcoat
5 or basecoat.

In the second step of the process of the invention a solid-colored topcoat material is applied and the resultant solid-colored topcoat film is heat cured to
10 give a solid-colored topcoat.

As an alternative to this, in the second process step an aqueous basecoat material is applied and the resultant aqueous basecoat film is partially dried and
15 in the third process step a clearcoat material is applied (wet-on-wet technique) and the resultant clearcoat and the aqueous basecoat film are jointly heat cured or cured by means of heat and by means of actinic light (dual cure) to give the basecoat and the
20 clearcoat.

In the context of the process of the invention, the clearcoat may also be further coated with an additional clearcoat material and the resultant clearcoat film may
25 be cured thermally and/or with actinic radiation to give a highly mar resistant clearcoat (sealer).

Suitable aqueous basecoat materials comprise at least one hydroxyl-containing binder in solution or

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universal scope for use and allows the realization of a large number of color shades and optical effects.

Effect pigments which can be used include metal plate
5 pigments such as commercial aluminum bronzes, the
chromated aluminum bronzes of DE-A-36 36 183,
commercial stainless steel bronzes, and nonmetallic
effect pigments, such as pearlescent pigments and
interference pigments, for example. For further details
10 refer to Römpp Lexikon Lacke und Druckfarben, Georg
Thieme Verlag, 1998, pages 176, "effect pigments" and
pages 380 and 381 "metal oxide-mica pigments" to "metal
pigments".

15 Examples of suitable inorganic color pigments are
titanium dioxide, iron oxides, Sicotrans yellow, and
carbon black. Examples of suitable organic color
pigments are thioindigo pigments indanthrene blue,
Chromophthal red, Irgazine orange, and Heliogen green.
20 For further details refer to Römpp Lexikon Lacke und
Druckfarben, Georg Thieme Verlag, 1998, pages 180 and
181, "iron blue pigments" to "black iron oxide",
pages 451 to 453 "pigments" to "pigment volume
concentration", page 563 "thioindigo pigments" and
25 page 567 "titanium dioxide pigments".

The fraction of the pigments in the aqueous basecoat
material and solid-colored topcoat may vary extremely
widely and is guided primarily by the opacity of the

These pigments may also be incorporated into the aqueous basecoat materials of the invention by way of pigment pastes, in which case the polyurethanes (A), inter alia, are suitable grinding resins.

Examples of suitable crosslinking agents are amino resins, compounds or resins containing anhydride groups, compounds or resins containing epoxide groups,

tris(alkoxycarbonylamino)triazines, compounds or resins containing carbonate groups, blocked and/or nonblocked polyisocyanates, beta-hydroxyalkylamides, and compounds containing on average at least two groups capable of transesterification, examples being products of the reaction between malonic diesters and polyisocyanates or between esters and partial esters of polyhydric alcohols of malonic acid and monoisocyanates, as described by European patent EP-A-0 596 460.

10

Examples of highly suitable aqueous basecoat materials and also the corresponding coatings are known from patents EP-A-0 089 497, EP-A-0 256 540, EP-A-0 260 447, EP-A-0 297 576, WO 96/12747, EP-A-0 523 610, EP-A-0 228 003, EP-A-0 397 806, EP-A-0 574 417, EP-A-0 531 510, EP-A-0 581 211, EP-A-0 708 788, EP-A-0 593 454, DE-A-43 28 092, EP-A-0 299 148, EP-A-0 394 737, EP-A-0 590 484, EP-A-0 234 362, EP-A-0 234 361, EP-A-0 543 817, WO 95/14721, EP-A-0 521 928, EP-A-0 522 420, EP-A-0 522 419, EP-A-0 649 865, EP-A-0 536 712, EP-A-0 596 460, EP-A-0 596 461, EP-A-0 584 818, EP-A-0 669 356, EP-A-0 634 431, EP-A-0 678 536, EP-A-0 354 261, EP-A-0 424 705, WO 97/49745, WO 97/49747, EP-A-0 401 565, EP-B-0 730 613 or WO 95/14721.

25

Particular advantages are afforded by physically curing aqueous basecoat materials, which are therefore employed with preference in accordance with the

invention.

Examples of suitable clearcoat materials are two-component clearcoat materials. As is known, the two
5 component clearcoat materials comprise a component I having at least one hydroxyl-containing binder and a component II having at least one polyisocyanate. Until they are used in unison, components I and II are stored separately from one another.

10

Examples of suitable polyisocyanates are those described above.

Examples of suitable hydroxyl-containing binders are
15 oligomeric or polymeric, random, alternating and/or blocked, linear and/or branched and/or comb, addition (co)polymers of ethylenically unsaturated monomers or polyaddition resins and/or polycondensation resins. For further details of these terms refer to Römpp Lexikon
20 Lacke und Druckfarben, Georg Thieme Verlag, Stuttgart, New York, 1998, page 457, "polyaddition" and "polyaddition resins (polyadducts)" and also pages 463 and 464, "polycondensates", "polycondensation", and "polycondensation resins".

25

Examples of highly suitable addition (co)polymers are poly(meth)acrylates and partially hydrolyzed polyvinyl esters.

Examples of highly suitable polyaddition resins and/or polycondensation resins are polyesters, alkyds, polyurethanes, polylactones, polycarbonates, polyethers, epoxy resin-amine adducts, polyureas, 5 polyamides or polyimides.

The hydroxyl-containing binders or resins for use in accordance with the invention are oligomers and polymers. In the context of the present invention, 10 oligomers are resins which contain at least 2 to 15 repeating monomer units in their molecule. In the context of the present invention, polymers are resins which contain at least 10 repeating monomer units in their molecule. For further details of these terms 15 refer to Römpp Lexikon Lacke und Druckfarben, Georg Thieme Verlag, Stuttgart, New York, 1998, "oligomers", page 425.

The hydroxyl-containing resins for use in accordance 20 with the invention contain primary and/or secondary hydroxyl groups. It is a quite substantial advantage of the process of the invention that both kinds of hydroxyl groups can be used. This makes it possible to tailor the reactivity of the resins by playing on 25 steric effects.

The OH number of the hydroxyl-containing resins for use in accordance for the invention may vary very widely and is preferably from 10 to 500, more preferably from

20 to 400, and in particular from 30 to 350 mg KOH/g.

The resin may further contain at least one functional group which on exposure to actinic radiation reacts
5 with a group of its own kind or with another functional group. These functional groups may already be present in the hydroxyl-containing resins for use in accordance with the invention or may be introduced subsequently into the resins by means of polymer-analogous
10 reactions.

Examples of suitable functional groups of this kind are allyl, vinyl acrylate or methacrylate groups, especially acrylate groups. The actinic radiation may
15 comprise electromagnetic radiation such as X-rays, UV radiation, visible light or near IR (NIR) light, or corpuscular radiation such as electron beams.

Of the hydroxyl-containing binders described above, the
20 poly(meth)acrylates, the polyesters, and the polyurethanes are used with preference. Particular advantages result from the joint use of the poly(meth)acrylates and of the polyesters.

25 Besides the binder and the polyisocyanates, the two-component clearcoat materials for use in accordance with the invention may further comprise the above-described customary coatings additives in the known, effective amounts. It is self-evident that the only

additives employed here will be those which do not impair the transparency of the clearcoat. Further examples of suitable additives for clearcoat materials are

5

- crosslinking catalysts such as dibutyltin dilaurate, lithium decanoate or zinc octoate;

10

- transparent fillers based on silicon dioxide, aluminum oxide, titanium dioxide or zirconium oxide; for further details refer to Römpp Lexikon Lacke und Druckfarben, Georg Thieme Verlag, Stuttgart, 1998, pages 250 to 252;

15

- sag control agents such as ureas, modified ureas and/or silicas, as described, for example, in the references EP-A-192 304, DE-A-23 59 923, DE-A-18 05 693, WO 94/22968, DE-C-27 51 761, WO 97/12945 or "farbe + lack", 11/1992, pages 829 ff;

20

and/or

- flatting agents such as magnesium stearate.

25

Examples of suitable clearcoat materials for producing highly mar resistant clearcoats are organically modified ceramic materials, which are sold, inter alia, under the brand name ORMOCER®.

In the context of the process of the invention, the

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coating materials described above may be applied by any customary application method, such as spraying, knife coating, spreading, flow coating, dipping, impregnating, trickling or rolling, for example. The plastics part to be coated may itself be at rest, with the application unit or equipment being moved. Alternatively, the plastics part to be coated may be moved, with the application unit being at rest relative to the substrate or being moved appropriately. The choice of which method to employ is guided primarily by the size of the substrate. Accordingly, a large plastics part will be coated first and foremost using movable application equipment.

Preference is given to using spray application methods, such as compressed air spraying, airless spraying, high speed rotation, electrostatic spray application (ESTA), together if desired with hot spray application such as hot air spraying, for example. Application can be conducted at temperatures of max. 70 to 80°C, so that suitable application viscosities are achieved without the coating material and its overspray, which may be intended for reprocessing, undergoing any change or damage during the short period of thermal exposure. Accordingly, hot spraying can be configured in such a way that the coating material is heated only very shortly in the spray nozzle or a short way upstream of the spray nozzle.

The spray booth that is used for application may be operated, for example, with an optionally temperature-controllable circulation system which is operated with a suitable absorption medium for the overspray, an
5 example being the coating material itself.

Where the clearcoat material includes constituents which are crosslinkable with actinic radiation, application is carried out under illumination with
10 visible light with a wavelength of more than 550 nm, or in the absence of light. This prevents material change or damage to the coating material and the overspray.

In general, the electrically conductive hydroprimer
15 film and the light-colored hydroprimer film, the solid-colored topcoat film, the basecoat film, and the clearcoat film are applied in a wet film thickness such that curing thereof gives coats having the thicknesses which are necessary and advantageous for their
20 functions. In the case of the hydroprimer coating of the invention this thickness is from 5 to 100, preferably from 10 to 80, with particular preference from 10 to 60, and in particular from 10 to 40 μm ; in the case of the light-colored hydroprimer coat this
25 thickness is from 5 to 100, preferably from 10 to 80, with particular preference from 10 to 60, and in particular from 10 to 40 μm ; in the case of the topcoat it is from 5 to 90, preferably from 10 to 80, with particular preference from 15 to 60, and in particular

Heat curing may take place after a certain rest period. This period may have a duration of from 30 s to 2 h, preferably from 1 min to 1 h, and in particular from 1 min to 45 min. The rest period serves, for example, for leveling and degassing of the paint films or for the evaporation of volatile constituents such as solvents. The rest period may be assisted and/or shortened by using elevated temperatures up to 90°C and/or by a reduced air humidity < 10 g water/kg air, especially < 5 g water/kg air, provided this does not entail any damage or change to the paint films, such as premature complete crosslinking.

Heat curing has no special features in terms of its method but instead takes place in accordance with the customary and known methods such as heating in a forced
25 air oven or irradiation using IR lamps. Heat curing may also take place in stages. Advantageously, heat curing is effected at a temperature from 50 to 100°C, with particular preference from 80 to 100°C, and in particular from 85 to 100°C, for a time of from 1 min

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up to 2 h, with particular preference from 2 min up to 1 h, and in particular from 3 min to 45 min.

Given an appropriate material composition of the
5 coating material, heat curing may be supplemented by
curing with actinic radiation, for which in particular
UV radiation and/or electron beams may be used. If
desired, it may be supplemented or carried out with
actinic radiation from other radiation sources. In the
10 case of electron beams it is preferred to operate under
an inert gas atmosphere. This can be ensured, for
example, by supplying carbon dioxide and/or nitrogen
directly to the surface of the paint film.

15 In the case of UV radiation curing as well it is
possible to operate under inert gas in order to prevent
the formation of ozone.

Curing with actinic radiation is carried out using the
20 customary and known radiation sources and optical
auxiliary measures. Examples of suitable radiation
sources are high or low pressure mercury vapor lamps,
which may have been doped with lead in order to open up
a radiation window up to 405 nm, or electron beam
25 sources. The arrangement of these sources is known in
principle and may be adapted to the circumstances of
the work piece and the process parameters. In the case
of work pieces of complex shape, those regions not
accessible to direct radiation (shadow regions) such as

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cavities, folds, and other structural undercuts may be cured using pointwise, small-area or all-round emitters in conjunction with an automatic movement means for the irradiation of cavities or edges.

5

The equipment and conditions for these curing methods are described, for example, in R. Holmes, "U.V. and E.B. Curing Formulations for Printing Inks", Coatings and Paints, SITA Technology, Academic Press, London, 10 United Kingdom 1984.

Curing may take place here in stages, i.e., by multiple exposure to light or actinic radiation. It may also be done alternately, i.e., by curing alternately with UV 15 radiation and electron beams.

Where heat curing and actinic radiation curing are employed together (dual cure), these methods may be employed simultaneously or alternately. Where the two 20 curing methods are used alternately, it is possible, for example, to begin with the heat cure and end with the actinic radiation cure. In other cases it may prove advantageous to commence with the actinic radiation cure and end with it. The skilled worker is able to 25 determine the method of curing that is particularly suitable for each individual case, on the basis of his or her general art knowledge with the assistance where appropriate of simple preliminary tests.

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deficient condensation resistance, cracking (mud cracking), leveling defects or surface textures.

In particular the multicoat paint system of the invention possesses an outstanding metallic effect, an
 5 outstanding D.O.I. (distinctiveness of the reflected image), and an outstanding surface smoothness. It is stable to weathering, resistant to chemicals and bird droppings, mar resistant, and exhibits very good reflow
 10 behavior.

A further key advantage is the very good overcoatability of the multicoat paint system of the invention, even without abrasion. As a result it can be
 15 coated easily with customary and known highly mar resistant coating materials based on organically modified ceramic materials.

Not least, however, it proves to be a very particular
 20 advantage that by means of the process of the invention it is possible to realize a multicoat paint system which is based predominantly on aqueous coating materials.

25 Accordingly, the plastics parts of the invention also have a relatively long service life, a better esthetic appearance, and improved technological usefulness, so making them particularly attractive economically.

Example

**The preparation of an inventive hydroprimer and its use
for producing an inventive multicoat color and effect
5 paint system**

For producing the multicoat paint system of the invention, first of all component I of the inventive hydroprimer was prepared as follows:

10

In a dissolver, 32 parts by weight of a commercial polyester-polyurethane dispersion, 1.7 parts by weight of Aerosil, 1.3 parts by weight of a commercial electrically conductive carbon black, 6.0 parts by weight of a commercial 3% Bentone paste, 1.5 parts by weight of butyl glycol, 1.5 parts by weight of a 52% strength wetting agent solution, 23 parts by weight of titanium dioxide, 13 parts by weight of barium sulfate, 3.7 parts by weight of talc and 1.1 parts by weight of a commercial emulsifier were mixed with one another for 20 minutes and up to a temperature of 60°C. Thereafter, the resulting mixture was ground in a stirred mill (ZWM mill) to a particle size of from 12 to 14 μm (Hegman wedge 25). Subsequently, 10.2 parts by weight of water and one part by weight of xylene were added, to give the component I for inventive use.

25

Shortly before application, component I was mixed with a commercial cycloaliphatic polyisocyanate (Desmodur®

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N 3400 from Bayer AG) (component II) in a weight ratio I:II of 100:6, after which the resulting inventive hydroprimer was applied by pneumatic spray application in a dry film thickness of from 20 to 25 μm to plastics
5 panels made of Noryl® GTX 964 (commercial blend of polyphenylene oxide and polyamide). The resultant hydroprimer film was flashed off at room temperature for 10 minutes and cured at a panel temperature of 90°C for 30 minutes.

10

The resultant inventive hydroprimer coating was then coated with a commercial aqueous basecoat material, after which the resultant aqueous basecoat film was flashed off at room temperature for 10 minutes.

15 Thereafter it was coated by the wet-on-wet technique with a commercial two-component clearcoat material, after which the aqueous basecoat film and clearcoat film were cured jointly at a panel temperature of 90°C for 30 minutes.

20

After the panels had been aged at 60°C for 2 days, they were subjected to the known DaimlerChrysler steam jet test. In the course of this test there were no instances of delamination whatsoever, which underlines
25 the outstanding adhesion of the inventive hydroprimer to the plastics parts on the one hand and to the aqueous basecoat on the other.

Comparative experiment

**The preparation of a noninventive hydroprimer and its
use for producing a conventional multicoat color and
5 effect paint system**

The example was repeated except that no xylene was
added to the hydroprimer. In the comparative
experiment, in contrast to the example, severe
10 delamination occurred during the DaimlerChrysler steam
jet test.

Claims

1. An electrically conductive hydroprimer for plastics, comprising

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I) at least one component comprising

A) at least one aqueous polyurethane dispersion and

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B) at least one electrically conductive pigment; and

II) at least one component comprising at least one polyisocyanate,

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characterized in that at least one of the components I and II comprises at least one aromatic solvent (D).

20

2. The hydroprimer of claim 1, characterized in that it contains the aromatic solvent or solvents (D) in an amount of from 0.1 to 10% by weight, based on the total amount of the hydroprimer.

25

3. The hydroprimer of claim 1 or 2, characterized in that the aromatic solvent (D) is selected from the group consisting of mononuclear or polynuclear

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aromatics or heteroaromatics which are unsubstituted or are mono-, di- or trisubstituted by alkyl, cycloalkyl, perhaloalkyl, perhalocycloalkyl alkyloxy, cycloalkoxy and/or perhaloalkyloxy groups, it also being possible for said groups to be linked cyclically to the aromatic nucleus or nuclei, and also mononuclear or polynuclear aromatics or heteroaromatics which are mono-, di- or trisubstituted by nitrile and/or nitro groups and/or halogen atoms.

4. The hydroprimer of any of claims 1 to 3, characterized in that mononuclear aromatics and/or heteroaromatics are used.

5. The hydroprimer of claim 3 or 4, characterized in that benzene, toluene, o-, m- and/or p-xylene, mesitylene, pseudocumene, hemellitene, ethylbenzene, cumene, p-cymene, tert-butylbenzene, chlorobenzene, o-, m- and/or p-dichlorobenzene, fluorobenzene, o-, m- and/or p-difluorobenzene, perfluorobenzene, nitrobenzene, benzonitrile, methoxybenzene, ethoxybenzene or thiophene is used.

6. The hydroprimer of any of claims 1 to 5, characterized in that the polyurethane dispersion (A) comprises at least one polyester-polyurethane (A) containing (potentially) cationic functional

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characterized in that it has a solids content of from 30 to 80% by weight, based on the hydroprimer.

5 13. Use of the hydroprimer of any of claims 1 to 12 for producing multicoat color and/or effect paint systems.

10 14. A process for producing multicoat color and/or effect paint systems on plastics parts by

15 1a) applying the hydroprimer of any of claims 1 to 12 and heat curing the resultant hydroprimer film to give the electrically conductive hydroprimer coating; or alternatively

20 1b) applying the hydroprimer of any of claims 1 to 12, drying the resultant electrically conductive hydroprimer film, applying a light-colored hydroprimer film, and jointly heat curing the resultant electrically conductive hydroprimer film and the light-colored hydroprimer film, to give the
25 electrically conductive hydroprimer coat and the light-colored hydroprimer coat; and

2a) applying a solid-color topcoat material and heat curing the resultant solid-color topcoat

2b) applying an aqueous basecoat material and partially drying the resultant aqueous basecoat film, and

15. The process of claim 14, characterized in that

16. A multicoat color and or effect paint system for plastics parts, which comprises the following coats atop one another in the stated sequence:

1a) an electrically conductive hydroprimer

1b) a light-colored hydroprimer coating, and

2b) a basecoat, and

10

15 18. Plastics parts coated with at least one multicoat
color and/or effect paint system of claim 16 or 17
and/or at least one multicoat color and/or effect
paint system producible as in claim 14 or 15.

20 19. The use of the plastics parts of claim 18 for
producing bodies for automobiles and for cabs of
commercial vehicles.

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20. An electrically conductive hydroprimer for plastics comprising
 - I) at least one component comprising
 - A) at least one aqueous polyurethane dispersion and
 - B) at least one electrically conductive pigment; and
 - II) at least one component comprising at least one polyisocyanate,wherein at least one of the components I and II comprise at least one aromatic solvent.
21. The hydroprimer of claim 20, wherein the aromatic solvent is present in the hydroprimer in an amount from 0.1 to 10% by weight based on the total weight of the hydroprimer.
22. The hydroprimer of claim 20, wherein the aromatic solvent is selected from the group consisting of mononuclear aromatic, polynuclear aromatic, mononuclear heteroaromatic, and polynuclear heteroaromatic, wherein the aromatic solvent is unsubstituted or is mono-, di-, or tri-substituted by at least one of an alkyl group, a cycloalkyl group, a perhaloalkyl group, a perhalocycloalkyl alkyloxy group, a cycloalkoxy group, a perhaloalkyloxy group, a nitrile group, a nitro group, and a halogen atom, and optionally wherein the alkyl group, the cycloalkyl group, the perhaloalkyl group, the perhalocycloalkyl alkyloxy group, the cycloalkoxy group, and the perhaloalkyloxy group can be linked cyclically to the aromatic nucleus or nuclei.

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23. The hydroprimer of claim 20, wherein the aromatic solvent is at least one of a mononuclear aromatic and a mononuclear heteroaromatic.
- 5 24. The hydroprimer of claim 20, wherein the aromatic solvent is selected from the group consisting of benzene, toluene, o-xylene, m-xylene, p-xylene, mesitylene, pseudocumene, hemellitene, ethylbenzene, cumene, p-cymene, tert-butylbenzene,
10 chlorobenzene, o-dichlorobenzene, m-dichlorobenzene, p-dichlorobenzene, fluorobenzene, o-difluorobenzene, m-difluorobenzene, p-difluorobenzene, perfluorobenzene, nitrobenzene, benzonitrile, methoxybenzene, ethoxybenzene,
15 thiophene, and mixtures thereof.
25. The hydroprimer of claim 20, wherein the polyurethane dispersion comprises at least one polyester-polyurethane containing at least one of
20 a cationic functional group; a functional group that can be converted into a cation by at least one of a neutralizing agent and a quaternizing agent; an anionic functional group; a functional group that can be converted into an anion by a
25 neutralizing agent; and a nonionic functional group based on a polyalkylene ether.
26. The hydroprimer of claim 25, wherein the functional group that can be converted into a
30 cation is at least one of a primary amino group, a secondary amino group, a tertiary amino group, a secondary sulfide group, and a tertiary phosphine group; wherein the cationic functional group is at least one of a secondary ammonium group, a

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tertiary ammonium group, a quaternary ammonium group, a tertiary sulfonium group, and a quaternary phosphonium group; wherein the functional group that can be converted into an anion is at least one of a carboxylic acid group, a sulfonic acid group, and a phosphonic acid group; and wherein the anionic functional group is at least one of a carboxylate group, a sulfonate group, and a phosphonate group.

10

27. The hydroprimer of claim 20, wherein the polyester-polyurethane comprises a reaction product of

- i) a polyesterpolyol
- 15 ii) a compound that provides at least one of a cationic functional group; a functional group that can be converted into a cation by at least one of a neutralizing agent and a quaternizing agent; an anionic functional group; a functional group that can be converted into an anion by a neutralizing agent; and a nonionic functional group based on a polyalkylene ether, and
- 20 iii) a polyisocyanate, and
- 25 optionally at least one of a polyamine and an amino alcohol.

28. The hydroprimer of claim 20, wherein the polyesterpolyol comprises a reaction product of

- 30 i) at least one of a polycarboxylic acid and an esterifiable derivative of a polycarboxylic acid, and optionally further including a monocarboxylic acid,
- wherein

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- i-a) the polycarboxylic acid is unsulfonated or sulfonated
- i-b) the polycarboxylic acid is saturated or unsaturated,
- 5 i-c) the esterifiable derivative of a polycarboxylic acid is unsulfonated or sulfonated, and
- i-d) the esterifiable derivative of a polycarboxylic acid is saturated or
- 10 unsaturated,
- and
- ii) at least one of a saturated polyol and an unsaturated polyol and optionally further including a monool.
- 15
- 29. The hydroprimer of claim 20, wherein the electrically conductive pigment is selected from the group consisting of a metal pigment, a conductivity black pigment, a doped pearlescent
- 20 pigment, a conductive barium sulfate, and mixtures thereof.
- 30. The hydroprimer of claim 20, wherein the hydroprimer further comprises at least one of an
- 25 electrically nonconductive pigment and a coatings additive.
- 31. The hydroprimer of claim 20, wherein the hydroprimer has a solids content of from 30% to
- 30 80% by weight based on the weight of the hydroprimer.
- 32. A process comprising applying the hydroprimer of claim 20 to a substrate to produce a multicoat

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and a curing with actinic light.

34. The process of claim 33 further comprising coating the clearcoat with a further clearcoat material to form a further clearcoat film and curing the further clearcoat film to give a mar resistant clearcoat, wherein the curing is one of i) heat curing or ii) heat curing and a curing with actinic light.
35. The process of claim 33, wherein the plastic part is one of an automobile body and a commercial vehicle cab.
36. The process of claim 33, wherein at least one of:
 - A. the aromatic solvent is present in the hydroprimer in an amount from 0.1 to 10% by weight based on the total weight of the hydroprimer;
 - B. the aromatic solvent is selected from the group consisting of mononuclear aromatic, polynuclear aromatic, mononuclear heteroaromatic, and polynuclear heteroaromatic, wherein the aromatic solvent is unsubstituted or is mono-, di-, or tri-substituted by at least one of an alkyl group, a cycloalkyl group, a perhaloalkyl group, a perhalocycloalkyl alkyloxy group, a cycloalkoxy group, a perhaloalkyloxy group, a nitrile group, a nitro group, and a halogen atom, and optionally wherein the alkyl group, the cycloalkyl group, the perhaloalkyl group, the perhalocycloalkyl alkyloxy group, the cycloalkoxy group, and the perhaloalkyloxy

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- neutralizing agent and a quaternizing agent; an anionic functional group; a functional group that can be converted into an anion by a neutralizing agent; and a nonionic functional group based on a polyalkylene ether, and
- 5 iii) a polyisocyanate, and optionally at least one of a polyamine and an amino alcohol;
- 10 G. the polyesterpolyol comprises a reaction product of
- i) at least one of a polycarboxylic acid and an esterifiable derivative of a polycarboxylic acid, and optionally
- 15 further including a monocarboxylic acid, wherein
- i-a) the polycarboxylic acid is unsulfonated or sulfonated
- i-b) the polycarboxylic acid is
- 20 saturated or unsaturated,
- i-c) the esterifiable derivative of a polycarboxylic acid is unsulfonated or sulfonated, and
- i-d) the esterifiable derivative of a
- 25 polycarboxylic acid is saturated or unsaturated,
- and
- ii) at least one of a saturated polyol and an unsaturated polyol and optionally
- 30 further including a monool;
- H. the electrically conductive pigment is selected from the group consisting of a metal pigment, a conductivity black pigment, a doped pearlescent pigment, a conductive

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barium sulfate, and mixtures thereof;

I. the hydroprimer further comprises at least one of an electrically nonconductive pigment and a coatings additive; and

5 J. the hydroprimer has a solids content of from 30% to 80% by weight based on the weight of the hydroprimer.

37. A multicoat paint system for a plastic part,
10 wherein the paint system is one of a color paint system, an effect paint system, and a color and effect paint system, comprising the following coats atop one another in the stated sequence:

1) one of

15 1a) an electrically conductive hydroprimer coating, or

1b) an electrically conductive hydroprimer coating and a light-colored hydroprimer coating, and

20 2) one of

2a) a solid-color topcoat, or

2b) a basecoat and a clearcoat;

25 wherein the electrically conductive hydroprimer coating is the application product of the hydroprimer of claim 20.

38. The multicoat paint system of claim 37 further comprising a sealer atop the clearcoat.

30 39. The plastic part produced by the process of claim 33.

40. The plastic part produced by the process of claim 34.

41. A plastic part comprising the multicoat paint system of claim 37.
- 5 42. A plastic part comprising the multicoat paint system of claim 38.

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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)		Attorney Docket No.	IN - 5571
		First Named Inventor	Guido WILKE
<input checked="" type="checkbox"/> Declaration Submitted with initial Filing or <input type="checkbox"/> Declaration Submitted after initial Filing (surcharge (37 CFR 1.16 (e)) required)		COMPLETE IF KNOWN	
		Application Number	
		Filing Date	March 28, 2002
		Group Art Unit	
		Examiner Name	

As below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

ELECTRICALLY CONDUCTING HYDROPRIMER FOR PLASTICS

(Title of the Invention)

The specification of which:

☒ is attached hereto

☒ Was filed on **05. October 2000** as United States Application or PCT International Application Number **PCT/EP00/09754** and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application

I hereby claim foreign priority benefits under 35, U.S.C § 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate or 365 (a) of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below, by checking the box, any foreign application(s) for patent or inventor's certificate, or any PCT international application(s) having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date DATE/MONTH/YEAR	Priority Not Claimed	Certified Copy Attached?	
199 48 821.5	GERMANY	9. October 1999	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Additional foreign application number are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:

I hereby claim the benefit under 35 U.S.C 119(e) of any United States provisional application(s) listed below:

APPLICATION NUMBER(S)	FILING DATE

☐ Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto

DECLARATION —	Utility or Design Patent Application
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POWER OF ATTORNEY

☒ I hereby appoint the practitioner(s) associated with the Customer Number provided below to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

1-00

Name OF SOLE OR FIRST NVENTOR:				<input type="checkbox"/> A petition has been filed for this unsigned inventor			
Given Name (first and middle [if any]) <u>Guido</u>				Family Name or Surname <u>WILKE</u>			
Inventor's Signature <u>Guido Wilke</u>				Date <u>28.07.02</u>			
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